The Citrus Industry

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Citrus Damage

This publication has conducted an exhaustive poll of the crop damage situation, as it pertains to citrus since the 2-day cold spell on Dec. 11 and 12.

We came up with only one practically unanimous opinion—that there was practically no tree damage to old trees, although in several instances younger trees suffered considerably.

Florida's largest citrus organizations, large growers and many important industry factors either reported that no accurate appraisal of fruit damage could be made this time, or made percentage of fruit loss estimates ranging all the way from 15 percent to 85 percent.

Many of our informants recalled the cold spells in 1934 and in 1940 when tree damage was much greater than now and cited that the overall return for the season's citrus crop was almost as large as in a normal season, as a result of the higher prices received for marketable fruit.

Florida citrus growers have a historic background of rapid recovery from reverses affecting the industry and this year, we believe, will be no exception.

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"ORTHO products have always produced highly desirable results,"

reports John M. Kennedy, Production Manager, Grand Island Citrus Co-Op, Umatilla, Fla., (pictured below, left, with ORTHO Fieldman Charles Ashley)

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R. M. Pratt

Citrus Insect Control

R. B. Johnson

For January 1958

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W. L. Thompson

Now that we have had freezing weather and growers have had an opportunity to assess the damage to citrus trees and fruit, the question that comes to mind is, "What effect has the recent cold had on citrus insects and mites, and can the spray program be modified as a result?" Considerable information on the effect of cold on citrus insects and mites is available, and this can be applied to the current situation. Following the 1940 freeze, Mr. W. L. Thompson, and Dr. Ralph L. Miller both reported in the Proceedings of the Florida State Horticultural Society for 1940, pages 64-72, that citrus pests in general were in an active state after the cold and that control measures could not be generally modified. These two papers are well worth reading. Both point out that the cold had little direct effect on citrus insects and mites, but reduced infestations indirectly by causing a drop of leaves on which they were feeding. This means that citrus pests will need as much controlling in January as ever, but it leaves the question, "Where and when should control measures be applied?" A good rule of thumb is: spray where defoliation was only slight to moderate with the idea of preventing any further damage, but delay spraying where defoliation has been severe.

Because there has not been a major freeze since the present forecasting survey was established in 1950, no reliable forecasts can be made.

Purple scale infestations have increased sharply since mid-October and were a little above average when this was written. The red scale population has been negligible this fall.

Purple mites have been scarce, but the Texas citrus mite was more widespread than in previous years, and in some areas was much more abundant than purple mite.

It is too early to say with certainty what the six-spotted mite situation will be this spring, but the first two weeks of December were rather consistently cold, and unless the rest of the month is unusually warm, it seems likely that this mite will be a problem.

Rust mite infestations increased rapidly from mid-October to mid-December, and are at a high level at this time.

January is an excellent time to examine trees for pest infestations to see what control measures must be applied before the appearance of the spring flush of growth. Spring may seem a long way off because of the present poor condition of many groves, but the spring flush may begin at any time. So examine as many groves as possible now so that sprays may be applied where needed for control of scales, mites, scab, and possibly mealybugs before the spring flush of growth stops spraying.

SCALE AND MITE ACTIVITY BY DISTRICTS*

District	Purple Scale	Red Scale	Purple Mite	Rust Mite on leaves	Rust Mite on fruit
West Coast	2.90	.33	1.00	2.00	2.00
Indian River	3.42	3.68	.81	1.67	1.38
Upper East Coast	2.65	2.50	1.72	2.58	1.34
Gainesville	3.20	.16	0	1.83	1.20
Orlando	2.95	1.62	1.73	1.00	1.00
Brooksville	2.95	.33	1.25	2.19	2.33
Ridge	3.77	2.59	.65	2.94	2.40
Bartow	4.78	.91	1.60	3.30	3.10
State Average	3.38	2.67	.99	2.19	1.86
Last Year	3.35	2.53	.97	1.50	1.10

*Third week in December. Activity is computed from populations, amount of hatching of scales, and number of groves with increasing or decreasing infestations. Activity is considered high if above 4.0 for purple scale, 3.0 for red scale, and 1.5 for mites.

SPRAY PROGRAM

Scale Control: In examining groves for infestations of scale insects, keep in mind that purple scale occurs on leaves, twigs and fruit; and that red scale will be found on leaves and fruit, but not as well distributed as purple scale. Red scale tends to occur in spot infestations on scattered trees, in parts of groves or even parts of trees.

After the grove has been checked for the presence of scale insects, a scale control program can be planned for about the next six months. To do this it is necessary to know how much scale is present and where it is located. A small amount of purple scale on leaves or twigs or on fruit that will drop as a result of cold damage will not necessitate spraying before post-bloom or even summer. On the other hand, an immediate spray is recommended where purple scale is sufficiently numerous on sound fruit or foliage to cause a severe leaf or fruit drop. Spraying is also recommended where even a small amount of purple scale occurs around the stem-end of sound fruit because this scale may result in severe fruit drop.

In the Indian River area from Sabastian southward, dormant or post-bloom scalicides are very effective against purple scale and may be used in preference to summer applications. Growers in this area are therefore advised to include a scalicide, preferably parathion in the January application.

Florida red scale poses a slightly different problem than purple scale, because being unevenly distributed, more careful checks are needed to detect it. Wherever red scale is

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*Written December 19, 1957. Reports of surveys by Harold Holtsberg, Fort Pierce; J. W. Davis, Tavares; K. G. Townsend, Tampa; T. B. Hallam, Avon Park; and L. M. Sutton, Lake Alfred.

CITRUS INSECT CONTROL FOR JANUARY, 1958

(Continued from Page 3)

numerous it should be controled be-numerous it should be controlled because red scale crawlers will move onto the new foliage and cause a severe distortion of the leaves. Where populations are now at low levels, however, sprays for red scale control should be delayed until post-bloom or even summer when a better kill can be obtained.

Parathion or malathion are the recommended scalicides for winter use. Use 1.7 pounds of 15 percent parathion or 5.0 pounds of 25 percent malathion per 100 gallons for severe infestations. The lower amounts of 1.0 pounds of parathion or 3.0 pounds of malathion will be satisfactory for light infestations. Lime-sulfur for rust mite control may be used with parathion. Wettable sulfur, zineb, or any of the miticides recommended for purple and Texas citrus mite, and materials used for nutritional purposes may be used with either parathion or malathion.

Where oil sprays must be used, wait at least until the buds have burst to minimize the danger of more cold injury or further shock to already damaged trees. Do not apply oil on fruit that has not colored because it will prevent degreening in the coloring room.

Remember that dormant scalicides cannot be expected to replace the regular summer applications except in the Indian River area from Sebastian southward, where dormant and post-bloom scalicides have been especially effective.

Mealybug Control: Mealybugs usually are not a general problem, but they can cause a lot of fruit drop where they become numerous. January is an excellent time to look for the adult mealybugs and their cotton-covered egg masses on tree trunks and limbs. If either mealybugs or their egg masses are easy to find, a parathion spray should be applied after the eggs hatch, and special care should be taken to see that trunks and limbs are thoroughly sprayed.

Rust Mite Control: Many growers are wondering whether to use zineb in preference to sulfur or lime-sulfur for rust mite control in the dormant spray. Research conducted to date has shown that zineb is very effective in dormant sprays, but no better than wettable sulfur. The recommended sprays for dormant rust mite control are still 10 pounds of wettable sulfur or 1 gallon of lime-sulfur with 5 pounds of wettable sulfur per 100 gallons.

Purple Mite and Texas Citrus Mite Control: In examining groves for the presence of purple mite and Texas citrus mite, pay special attention to tree tops and the southeast section of the tree because these mites prefer these areas during the winter months. Both of these mites can cause a serious leaf-drop that could be especially severe on cold-damaged trees. To prevent serious injury, apply the recommended miticides, DN Dry Mix, Systox, ovex, or armite before more than 20 percent of the leaves become infested.

Three new miticides that are effective against both purple mite and Texas citrus mite are now available for use on Florida citrus without fruit. These miticides are Kelthane, Tedion, and Trithion. Although all three are recommended for use on trees without fruit, none is recommended for use on bearing trees because residues of all three must not occur on citrus fruit. No residue tolerance or waiting period between application and harvest has been established.

Kelthane is a formulation of 1,1-bis (chlorophenyl) -2,2,2-trichlorcethanol and is sold as an 18.5 percent wettable powder or an emulsion concentrate containing 2 pounds of the active ingredient per gallon. This miticide is recommended for the control of purple mite and Texas citrus mite only on trees without fruit at dosages of 1 to 1.5 pints of the emulsion concentrate, or 1 to 1.5 pounds of the wettable powder per 100 gallons of spray. Larger amounts of Kelthane will not improve mite control while smaller amounts will give a good initial kill, but may not last as long.

Kelthane should not be used in alkaline sprays such as those containing lime, but is believed to be compatible with other spray materials commonly used on citrus.

The use of Kelthane will aid in rust mite control, but it is not sufficiently effective to be used without sulfur or zineb. Kelthane gives a quick kill of mites, but is most effective during the winter months. Control of purple mite has not been satisfactory during the warmer spring months. Thorough coverage of all leaves and green twigs is necessary for best results.

Tedion is a formulation of 2,4,5,5 tetracholrodiphenyl sulphone and is sold as a 5 percent wettable powder. This miticide is recommended for use against purple mite and Texas citrus mite only on trees without fruit. A dosage of 1 pound per 100

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Zineb For The Control Of Rust Mites- Some Timely Observations & Answers

ROGER B. JOHNSON(1), JAMES E. BROGDON(2), JOHN R. KING(3)

Numerous questions have been raised by recent work which has shown that Zineb, when properly used, will control the citrus rust mite. Many of these questions can be answered now, but others require more study and observation. As work progresses and more information is obtained in the use of zineb for rust mite control, some of the statements made below may require changes and other questions will be answered more fully. Many of the questions commonly asked by citrus growers are answered below:

1. Q. What is zineb?

A. Zineb is a 65% wettable powder formulation of zinc ethylene bisdithiocarbamate and is used primarily as a fungicide. It contains 15.4% metallic zinc equivalent.

2. Q. Does zineb actually kill rust mites?

A. Yes. Laboratory experiments have shown that rust mites are not repelled by zineb, but are actually killed when in contact with zineb residues. Zineb does not, however, kill rust mite eggs. These hatch in the presence of zineb, but the young mites soon die.

3. Q. How can a fungicide control a mite?

A. Chemical compounds are called fungicides where they are used primarily to control fungi, insecticides where they are used to control insects, and acaricides or miticides where they control mites. Chemicals that have both fungicidal and insecticidal or miticidal properties are not uncommon. Sulfur, for example, is considered a miticide on citrus, but is used as a fungicide on apples.

4. Q. Is zineb compatible with other spray materials?

A. Zineb is compatible with the spray materials recommended for use on citrus. However, its effectiveness against rust mites may be reduced by copper and possibly calcium compounds.

5. Q. How does zineb compare with sulfur against rust mites during spring? summer? winter?

A. Results of research conducted to date have shown that zineb can be expected to give better control of rust mites than sulfur in post-bloom and summer sprays. There has been no difference between winter application of zineb and sulfur.

6. Q. How long will zineb protect citrus from rust mites?

A. The interval of control cannot be predicted on citrus for any mite with any miticide. About the only way to answer this question is to say that zineb should give longer control of rust mites than sulfur from the post-bloom period through the summer.

7. Q. Will only one application of zineb in July control rust mites during the year?

A. No. A July application is usually too late to prevent early rust mite damage to fruit and will not last through the winter.

8. Q. When should zineb be used? What dosage?

A. Zineb may be used on citrus at dosages of 1/2 to 1 pound per 100 gallons whenever control of rust mites is needed. However, it is currently recommended that the use of zineb be confined to post-bloom and/or summer sprays. The dosage of 1/2 pound per 100 gallons is preferable unless a copper compound is to be used in the same spray. Until more information on the miticidal effectiveness of zineb-copper sprays is available, the higher dosage of 1 pound of zineb per 100 gallons is recommended wherever zineb is to be used with copper compounds.

9. Q. What tentative rust mite program using zineb and sulfur might a grower consider?

A. It is currently recommended that zineb be used in post-bloom and summer sprays and sulfur in fall and winter sprays. Each application should be timed to prevent rust mite build-up to damaging numbers. Since Citrus Experiment Station records show that the occurrence of rust mites varies from year to year as well as from grove to grove, each grove should be periodically checked for rust mites so that sprays may be applied before more than 15% of the fruit or foliage is infested.

10. Q. Will growers have less trouble with purple mites and Texas citrus mites in groves sprayed with zineb than in sulfur-sprayed groves?

A. The answer to this question has not been thoroughly determined. However, in experimental plots, purple mites have been just as numerous or even more numerous on zineb-

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The Effect Of Pack-Out On Grower Profits

Planning a research program calls for a critical consideration of which problems are most urgent and which approach to such problems will give the greatest return for expenditure of research money and effort.

Such an approach indicates that crop disposition is one of the weakest links in the Florida citrus industry and that low pack-outs are to a great extent responsible. This is particularly so with regard to seedy grapefruit and tangerines.

An evaluation has been made of the effect of pack-out on the profits derived from various varieties of citrus. The figures so obtained are presented here with the intention of demonstrating: (1) The effect of pack-out on final profit or loss; (2) How these pack-outs compare with those of a representative growers' association; (3) When (if ever) it would have been more profitable to ship the whole crop directly to the cannery; (4) Possible modifications to growing, marketing and accounting methods.

In addition some generalized charts and formulas are given to help individual operators apply such calculations to their own operations.

Methods

The observations and calculations presented here do not constitute a formal economic study. They are incidental to a critical evaluation of how to apply certain research facilities where they would do most good.

Available figures on costs, prices and economics generally deal very largely with averages, such as average prices over a season, average costs for widely differing types of operations, averages of returns for different types of fruits, etc. (2, 6, 7, 8, 11). Useful as such averages have been for many purposes, the continual use of such averaged figures has apparently obscured rather than illuminated the effect of pack-out on profits. Hence a new approach has been sought.

With regard to prices, detailed daily figures are available from the daily market bulletins published by

DR. W. GRIERSON(1)

AT MEETING FLORIDA STATE HORTICULTURAL SOCIETY

Florida Citrus Mutual (15). This has allowed the somewhat radical procedure of chosing particular dates, varieties and sizes and working out examples based on these dates. The dates have been chosen to illustrate various market conditions, principally the extremes of prices encountered in the last two seasons. Two early season dates were chosen as typifying a day when prices were very poor (November 30, 1955) and a day when prices were good (November 15, 1956). Since neither date is well into the tangerine season, December 14, 1956, was added. In order to include Valencia oranges, April 27, 1956, and May 10, 1957, were also added, the latter date being after the severe price break in the spring of 1957. The material in Tables 1 and 2 is limited to these particular examples.

In addition generalized charts and graphs have been drawn showing the effect of a wide range of prices and pack-outs on profits. It was felt that such a procedure would make it easier for the individual operator to interpret these results in terms of his own operation than if averages had been used.

For costs no such detailed figures were available. The hardest figures to arrive at have been estimates of the cost of growing various varieties since both grove records and published reports include figures on blocks of mixed varieties. The figures used have been based on published averages (6) modified and interpreted after discussion with citrus operators and economists. It is stressed that growing costs have surprisingly little effect on the ultimate profit or loss from a crop sent to the fresh fruit packinghouse and hence the conclusions presented here are still tenable in situations where growing costs differ from those used here.

Costs of picking and hauling (8, 12) and of packinghouse procedures (9, 11, 13, 14) are largely taken from the published reports of the Department of Agricultural Economics, University of Florida, which bases its figures on costs from 40 or more representative packinghouses.

Findings

Table 1 shows an analysis for five particular dates of the profitableness of packing certain sizes and varieties of fresh citrus. The final column shows the "pack-out to break even" i.e. the pack-out at which money is neither being lost nor made.

Table 2 shows the relationship between pack-out and profits for the conditions established in Table 1. Table 3 shows pack-outs at an actual packinghouse. The house chosen is a large one in the Ridge district belonging to a growers association that is probably of well above average efficiency. When figures were not available for the same dates as in Table 1, the nearest possible date was chosen.

Following a single example through these tables it will be seen from Table 1 that on November 30, 1955, size 70 Duncan grapefruit would have to pack-out 74 per cent to break even. Referring to Table 3 it will be seen that on the date the representative packinghouse packed-out 60 percent. Turning back to Table 2 it will be seen that this would have resulted in an out-of-pocket loss of $10.40 per 100 boxes delivered in. The asterisks in Table 2 indicate the lowest pack-out at which it would have

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been more profitable to pack as fresh fruit rather than to send this crop direct to the cannery. For the date of this example (November 30, 1955) a pack-out of 40 percent would be required. Hence, not quite as much money was lost by running it at a 60 percent pack-out as would have been lost if it had been sent direct to the cannery for the price being offered that day. This does not take into account any possible savings due to bulk methods for cannery-operation, but it does allow for the prices being paid for grove-run fruit.

On November 15, 1956, F.O.B. prices were good and the break-even point for seedy grapefruit packed as fresh fruit came as low as 20 percent pack-out. Our representative house was packing 66 percent on that day and would have made (interpolating from Table 2) a profit of $62.16 for every 100 boxes delivered into the packing-house. If they could have raised the pack-out to 76 percent, then profit would have gone up to $79.76 per one hundred boxes. An increase in net profits of 28 percent.

This marked increase in profits for a small increase in pack-out is typical. Table 4 shows an analysis of the potential effect of pack-out on the returns from seedy grapefruit in terms of the seasonal average prices for the last two years. No record is available for average pack-out for the season, but 60 percent could be taken as representative for Interior grapefruit. In a year when prices were good, 1956-57, raising this pack-out to 70 percent would have meant an increased return of 15.7 cents per box or a gain of 28 percent. In a year when prices were poor, 1955-56, a similar increase in pack-out brought a smaller monetary gain (10.8 cents) but an extraordinary percentage increase in profits of 128 percent.

Figure 1 shows a generalized set of curves based on the costs shown in Table 1, an average price of 45 cents for eliminations and a wide range of F.O.B. prices. From this it can be seen that at low pack-outs and/or low prices grapefruit are apt to be packed at a loss. The effect of a given increase in pack-out on final profits depends on the slope of the price curve and ranges from a $7.00 to $18.00 gain per hundred boxes for each ten percent increase in pack-out.

For tangerines the situation is somewhat similar except that, although tangerine eliminations sell at a loss of $1.50 to $1.75, the pack-outs necessary to break even are lower (27 to 49 percent) than those usually encountered in commercial practice. Referring to Figure 2 it will be seen that (for the costs assumed here) even at $2.00 F.O.B. per 4/5 bushel box, the break even point is as low as 64 percent. But the monetary gain due to raising the pack-out is exceptionally high. Reading off from the lines for F.O.B. prices of $2.00 and $4.00 in Figure 2 it is seen that an increase of ten percent in pack-out brings an increase return of $25.00 to $65.00 per 100 boxes delivered into the packinghouse.

Oranges present a very different picture since eliminations are normally disposed of at a profit. Hence the adverse effect of low pack-out is minimized and (in exceptional circumstances) may even be nullified or reversed. The pack-out at which it would have been more profitable to send the fruit direct to the cannery varies (for the dates examined here) from 20 to 70 percent and thus includes much of the range of pack-outs normally encountered in the packinghouse. (Tennant, (10), reported an average pack-out of 53 percent for all varieties handled by 33 packing-houses over a three year period.) Moreover, the price paid for orange eliminations varies so widely that a chart such as those in Figs. 1 and 2, based on an assumed single price for eliminations, would be

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Table 1: Some costs, prices and profits per box for grapefruit, tangerines and oranges on representative dates.

Fruit	Date	Estimated Avg. Expenditures: Growing—1	Pick & Haul—2	Packing—3	F.O.B. fresh prices—4	Profit on packed boxes	Cannery Elimin. Price	P.H. costs—5	Haul to Cannery—6	Profit or loss on elimina-tions	Pack-out to "break even"—7
		G	H	P	F	A	E	Q	T	B	
Duncan size 70	Nov. 30 1955	$0.40	$0.33	$0.80	$1.75	$0.22	$0.40	$0.26	$0.05	-$0.64	74%
	Nov.15 1956	0.40	0.33	0.80	2.75	1.22	0.50	0.26	0.05	-$0.54	20%
Tangerines size 176	Nov. 30 1955	0.90	0.77	1.43	5.00	1.90	0.40	0.43 (est)	0.05	-$1.75	48%
	Nov. 15 1956	0.90	0.77	1.43	8.00	4.90	0.30	0.43	0.05	-$1.85	27%
	Dec. 14 1956	0.90	0.77	1.43	5.50	2.40	0.65	0.43	0.05	-$1.50	39%
Early Oranges size 216	Nov. 30 1955	0.60	0.41	0.89	2.75	0.83	1.65	0.38	0.05	+$0.21	0
	Nov. 15 1956	0.60	0.41	0.89	3.00	1.10	1.40	0.38	0.05	-$0.04	3.5%
Valencia Oranges Size 216	Apr. 27 1956	0.65	0.41	0.89	3.75	1.80	2.30	0.38	0.05	+$0.81	0
	May 10 1957	0.65	0.41	0.89	3.00	1.05	1.35	0.38	0.05	-$0.14	10%

1. Compounded from figures from Florida Citrus Mutual (2), the Florida Citrus Commission (1) and the Dept. of Agricultural Economics, University of Florida (5, 6) and allowing for the fact that the cost of growing early oranges is somewhat less than Valencias.
2. From Spurlock, 1956, (8).
3. From Thor and Spurlock. Does not include allowance for high overhead costs early in the season.
4. Florida Citrus Mutual Daily Market Bulletin (15). All FOB prices as for 1-3/5 bus. Interior fruit in wirebound boxes.
5. Taken as being as for fruit sold in bulk (9, 13), less costs of taxes, inspection charges, color-add and waxing.
6. Purely arbitrary figure, kept as low as seemed reasonable.
7. When: X = packout to break even; A = profit per box sold FOB; and B = loss per box on eliminations; then $X = \frac{100\ B}{A + B}$

Table 2: Relationship between pack-out and profits using the same data as shown in Table 1.

Pack-out as percent	Profits per 100 boxes delivered into the packinghouse. Grapefruit: Nov. 30, 1955	Grapefruit: Nov. 15, 1956	Tangerine: Nov. 30, 1955	Tangerine: Nov. 15, 1956	Tangerine: Dec. 14, 1956	Early Oranges: Nov. 30, 1955	Early Oranges: Nov. 15, 1956	Valencia Oranges: Apr. 27, 1956	Valencia Oranges: May 10 1957
0	-$64.00	-$54.00	-$175.00	-$185.00	-$155.00	+$21.00	-$ 0.40	+$ 81.00	-$ 14.00
10	- 55.40	- 36.40	- 138.50	- 117.50*	- 115.50	27.20	+ 29.64	90.90	- 2.10
20	- 46.80	- 18.80*	- 102.00*	- 50.00	- 76.00*	33.40	59.68*	100.80	+ 9.80
30	- 36.20	- 1.20	- 65.50	+ 17.50	- 36.50	39.60	89.72	110.70	21.70
40	- 27.60*	+ 16.40	- 29.00	85.00	+ 3.00	45.80	119.76	120.60	33.60
50	- 19.00	34.00	+ 7.50	152.50	42.50	52.00	149.80	130.50*	45.50*
60	- 10.40	51.60	44.00	220.00	82.00	58.20	179.84	140.40	57.40
70	- 1.80	69.20	80.50	287.50	121.50	64.40*	209.88	150.30	69.30
80	+ 6.80	86.80	117.00	355.00	161.00	70.86	239.92	160.20	81.20
90	15.40	104.40	153.50	422.50	200.50	76.80	269.96	170.10	93.10
100	22.00	122.00	190.00	491.00	240.00	83.00	300.00	180.00	105.00

* At this pack-out (and above) it is more profitable to run the crop through the packinghouse than to send direct from the grove to the cannery.

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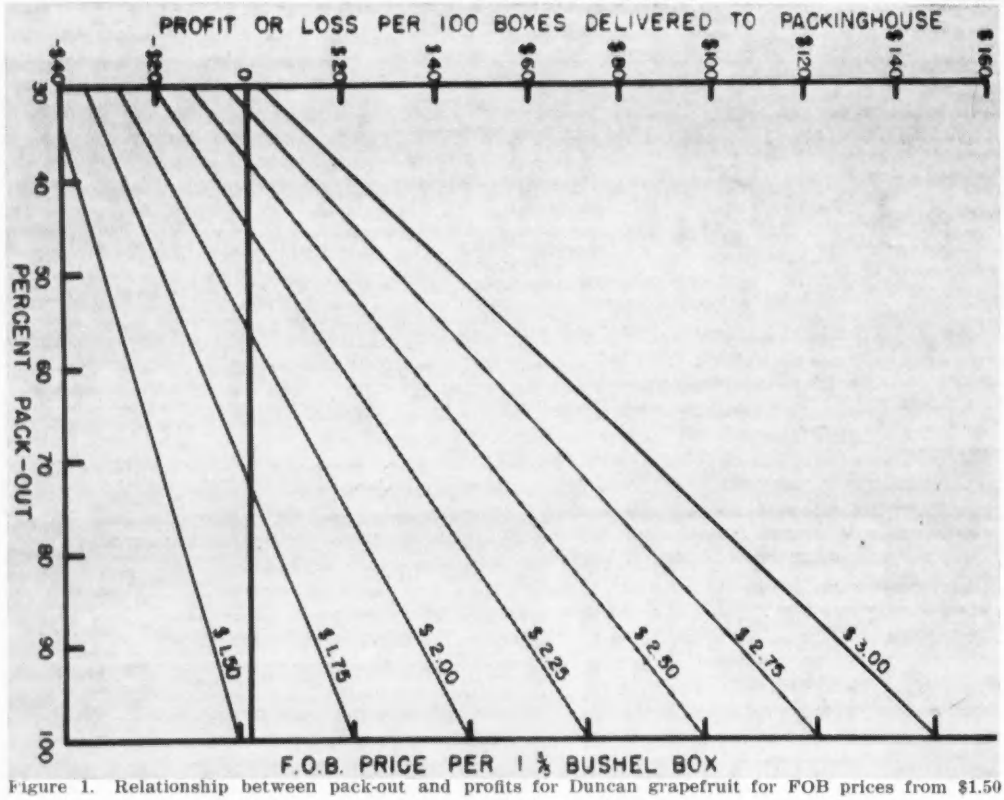

Figure 1. Relationship between pack-out and profits for Duncan grapefruit for FOB prices from $1.50 to $3.00 and an assumed price of 45 cents for packinghouse elimination.

THE EFFECT OF PACK-OUT ON GROWER PROFITS

(Continued from page 10)

meaningless. Hence a combined graph and nomograph has been presented in Figure 3. From this the pack-out to break even and the total profit per one hundred boxes dumped can be read off for various combinations of prices for F. O. B. and for eliminations. This assumes

(Please Turn To Next Page)

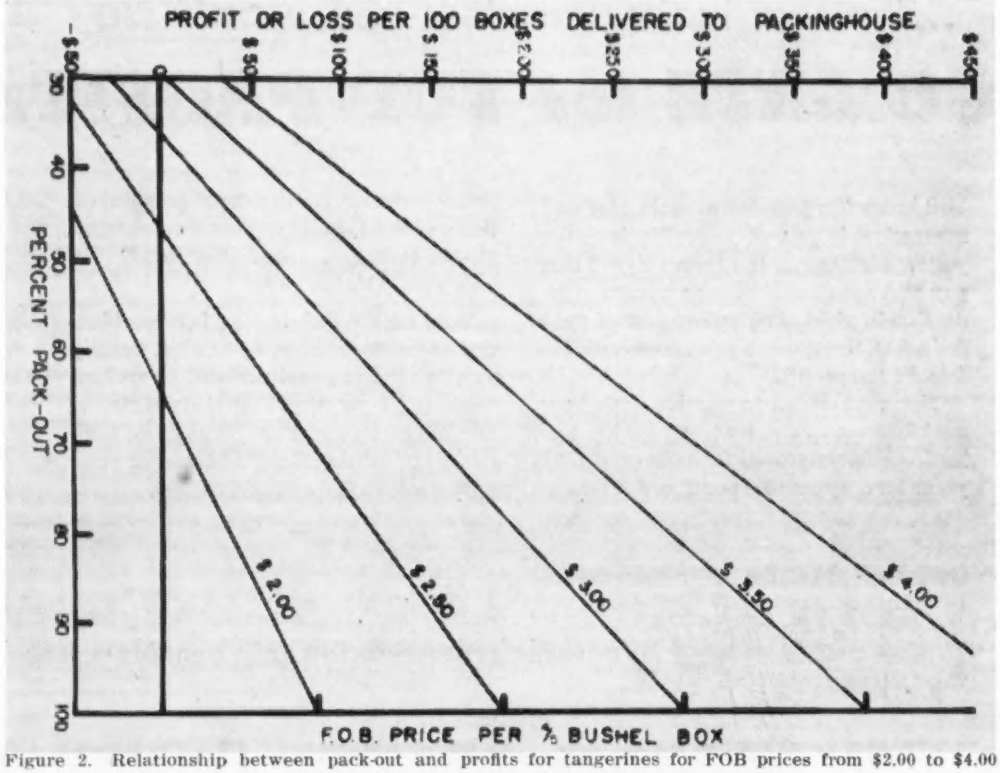

Figure 2. Relationship between pack-out and profits for tangerines for FOB prices from $2.00 to $4.00 per 4/5 bushel box and an assumed price of 50 cents for packinghouse eliminations.

the same costs as used in Table 1.

Discussion

In no case examined here was a profit made on packinghouse eliminations of Duncan grapefruit or of tangerines. The least losses encountered with these varieties was 54 cents lost per box on grapefruit eliminations and $1.55 on tangerines. With Duncan grapefruit the pack-out achieved could determine whether the crop was handled at a profit or a loss. Tangerines were unlikely to be packed at a loss, but the profit made was very strongly influenced by pack-out.

Since considerable money is lost in grading out grapefruit and tangerines, it becomes apparent that for these types of citrus the pack-out obtained is an economic factor comparable to that of yield per acre. High yields bring down costs per box, that is axiomatic. But if much of the fruit is then handled at an out-of-pocket loss then the low costs due to high yields are counter-acted. Hence, to obtain the largest net returns with grapefruit and tangerines it may become worth while to raise the pack-out even if though this may incur a reduction in total yield and/or an increase in production costs per box. Of course there is not necessarily any direct relationship between yield and pack-out, although occasional examples can be found where practices that result in a lower total yield per acre produce more boxes of packable fruit. Norris (4) reports some remarkable effects due to hedging, particularly of tangerines. In the most striking of the various examples he describes, hedging reduced the yield of a given 900-tree block from 6,087 boxes to 3,564 boxes in the season after hedging. Pack-out was raised from 36 percent to 84 percent. The writer does not have costs and prices on this grove. But let us presume that the cost of hedging and the reduction of yield raised cost of production by 60 cents per box. Presuming an F.O.B. price of $2.50 per 4/5 bushel box and 50 cents for eliminations (all very conservative figures) and other costs as in Table 1, then:

	Last year prior to hedging	First year after hedging
Profit on fruit packed	$4,193.30	$3.906.50
Loss on fruit eliminated	6,208.00	1,229.80
Net returns	-2,014.70	+2,676.70

A tight spot-picking program is another way of raising pack-outs of tangerines and has been discussed elsewhere (3). Unfortunately examples of practices that can raise pack-out sharply are not usually so well defined, but the need for them is very apparent, especially with grapefruit and tangerines.

Utilization of pack-out data

Much of the economic pattern for the Florida citrus industry is related to two sets of figures. In any individual operation the most readily arrived at cost figure is that of production costs, which are usually expressed as costs per box and in which yield is the single most important consideration. The other readily available figure is that of Florida Citrus Mutual's constantly revised estimate of what fruit is

Table 3: Actual pack-out figures from a representative efficient growers association for approximately the same dates as used in Tables 1 and 2.

Date	Grapefruit	Oranges	Tangerines
		Early	
Nov. 30, 1955	60%	62%	76%
Nov. 15, 1956	66%	55%	81%
Nov. 19, 1956	70%	74%	95%
Dec. 14, 1956	57%	59%	70%
		Valencia	
April 27, 1956	—	46%	—
May 10, 1957	—	42%	—

Table 4: Returns from seedy grapefruit for 1955-56 and 1956-57 as related to prices and pack-out.

	1955-56		1956-57	
	F.O.B.	Eliminations*	F.O.B.	Eliminations*
Average price for season**	$2.05	$0.48	$2.71	$0.65
Estimated costs***	1.53	1.04	1.53	1.04
Profit or loss	+ 0.52	- 0.56	+ 1.18	- 0.39
Pack-out to "break-even"	52 percent		25 percent	
Profit per box at 60 percent pack-out	8.8 cents		55.2 cents	
Profit per box at 70 percent pack-out	19.6 cents		70.9 cents	
Increase in profit due to ten percent higher pack-out	10.8 cents per box (123 percent increase)		15.7 cents per box (28 percent increase)	

*Price for eliminations taken as average season price for seedy grapefruit for juice less two cents.
** Average prices for season (both F.O.B. and cannery) supplied by Florida Citrus Mutual.
*** Estimates costs from Table 1.

worth per box. Neither figure takes account of pack-out.

A further complication is that fruit may be grown, packed and sold by a single management; it may be grown by individual operators but sold through a cooperative; or it may be sold "on the tree."

When the entire operation is directed by a single manager it is easy for him to see how much profit will result from increasing pack-out. But it is common for separate accounting to be made on individual groves, with the fruit pooled once it reaches the packinghouse. In such a case the efficiency of the production manager is rated quite largely according to his per box costs. Increased pack-out at expense of yield (as in the hedging operation quoted above) is also at the expense of his per box costs. An annual re-evaluation of such per box costs in terms of the pack-outs achieved would help the production manager greatly by removing from him any blame for apparent increases in costs.

Pack-out should be taken into consideration in on-tree sales of citrus for fresh fruit use and Mutual's estimate of worth modified accordingly. It is becoming a common and desirable practice for canners to purchase fruit according to sugar content ("pounds of solids per box"). Variations in pack-out, particularly of grapefruit and tangerines, affect the fresh fruit packer far more than the usual variations in solids affect the canner. What is needed is a useful yardstick by which to measure the worth of the crop as fresh fruit and pack-out is the obvious one to use. Both buyers and sellers need to be able to adjust the 'estimated value' of the crop according to the anticipated pack-out and current F.O.B. and packinghouse elimination prices. For crops under a single management from tree to packinghouse a somewhat similar computation could help in the problem of which crops to pick and which to hold onto or send direct to the cannery.

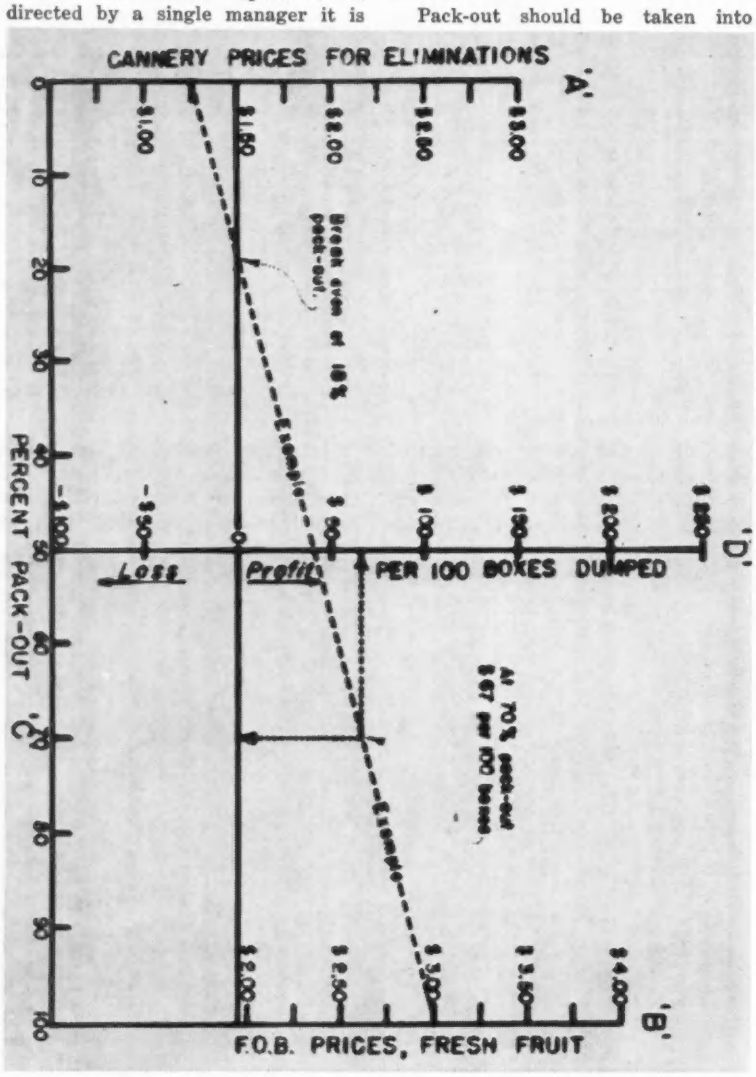

Figure 3. Effect of pack-out, FOB price and cannery price for packinghouse eliminations on profits. (To use this graph lay a straight edge from cannery price on the "A" scale to the FOB price on the "B" scale. Locate pack-out on the "C" scale and follow vertically to the straight edge. Follow across horibontally to the "D" scale and read off estimated profit per 100 boxes dumped. This presumes costs as in Table 1.)

Estimation of profit for a given crop and market

Packinghouse operators wishing to apply the type of approach used in these calculations first need to know the pack-out they are likely to get from a given crop. This is obviously a matter of sampling and estimation by an experienced grader. The next step is to calculate the pack-out at which the break even point occurs and see whether it is above or below the estimated pack-out for the crop. Many operators do not have adequate records to provide the necessary figures, but for those that do, the following equation may prove useful.

$$x = 100 \left(\frac{G + H + Q + T - E}{F + Q + T - (E + P)} \right)$$

Where: G = per box cost of growing

H = per box cost of picking and hauling

P = per box cost of packing 1-3/5 bus. wirebound box

Q = per box cost of running eliminations through packinghouse

T = per box cost of delivering eliminations to cannery

E = per box price received for eliminations

F = F. O. B. price fresh fruit (per 1-3/5 bus.)

X = Pack-out necessary to break even

In actual practice circumstances when such calculations can be projectetd into the future will be uncommon. However the application of such methods even in retrospect should prove useful.

Current research

Various research workers at the Citrus Experiment Station have long been concerned with particular aspects of producing high quality fruit. Now, as a consequence of such studies as this one, efforts of

both production and packinghouse workers are being coordinated with a view to finding ways to raise pack-out, particularly of grapefruit and tangerines.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the help of those who contributed observations and advice, particularly Mr. R. L. White, Economist, Florida Citrus Mutual, and Mr. W. L. Thompson, Dr. H. J. Reitz and Dr. A. H. Krezdorn, Citrus Experiment Station.

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The U. S. Department of Agriculture on December 13 withdrew its offer of December 6 to buy canned concentrated orange juice for use in school lunch programs.

Bids were to be submitted early next week. The offer has been withdrawn until an appraisal can be made of any changes in the marketing situation which may result from the cold weather in Florida.

Concentrate For Lemonade From Meyer Lemon Juice

. . . By . . .
THOMAS S. STEPHENS
U. S. FRUIT AND VEGETABLE PRODUCTS LABORATORY(a)
WESLACO, TEXAS

Meyer lemons grown in the Lower Rio Grande Valley of Texas were harvested August 19, September 21, October 20, and November 18, 1954, and the juice extracted by three methods: reaming on a kitchen model electric burr reamer; squeezing with a household type hand operated lime squeezer; and forcing through a screw type juice extractor. The extracted juice was made into a concentrate for lemonade and frozen. Juice extracted from fruit harvested October 20 was divided into portions and different amounts of USP oil of lemon were added; then each portion was made into a concentrate for lemonade. The time of harvest had little effect on the flavor of lemonade prepared from the concentrate. The judges preferred lemonade made from hand squeezed juice to that prepared from either burr reamed juice or screw press extracted juice. After 14 months frozen storage a taste panel of 8 judges rated concentrate for lemonade made from Meyer lemon juice and fortified with .15 percent by volume USP oil of lemon, as good as a commercial brand of frozen concentrate for lemonade.

The Meyer lemon was brought to the United States in 1908 from near Pekin, China, by Frank N. Meyer, agricultural explorer for the U. S. Department of Agriculture. The tree is a dwarf type, cold-resistant plant, which produces an abundance of relatively large, thin-skinned juicy fruit. However, the fruit has proved to be of poor shipping quality (1) (3). Juice from the fruit is less acid than Eureka lemon juice (2), although appreciable quantities have been canned and chemically preserved (3). A few citrus juice concentrate plants in Florida have used some Meyer lemon juice in blends with other lemon varieties (4).

In discussions with users of Meyer lemon juice various opinions have been expressed concerning the quality of the juice. Some complain that true lemon flavor is lacking, while others prefer the juice because of its mildness.

The purposes of this investigation were to determine what effect time of harvest and method of extraction would have on yield, acid, Brix, and oil content of the fresh juice, and the flavor of lemonade made from a concentrate prepared from this juice; and also to determine if the addition of oil of lemon to the concentrate would result in a product similar in flavor to commercially prepared concentrate for lemonade now on the market.

Experimental

Meyer lemons were harvested at random from a twenty acre planting at Rio Farms, Inc. in the Rio Grande Valley of Texas. Fruit was harvested August 19, September 21, October 20, and November 18, 1954. Approximately 20 pounds of fruit were picked each harvest, except October 20 when 40 pounds were obtained. The fruit of each harvest was divided into three lots, washed and cut in half preparatory to juice extraction. The juice was extracted from each of the three lots by a different method. The three methods were chosen which would give minimum and maximum amount of natural Meyer oil in the extracted juice. The juice from the first lot was extracted by using a kitchen model electric burr reamer. Juice of the second lot was extracted, using a household type hand operated lime squeezer. Juice of the last lot was extracted by a screw type juice extractor, fitted with a .031 mesh screen. The majority of seeds were removed from each half of fruit and the unpeeled halves pressed through the juice extractor.

The juice from each lot for each harvest was weighed and percentage yield calculated. Sufficient fresh juice was removed from each lot for acid, Brix, and oil determinations. Acid, as citric, was determined by titrating with standardized sodium hydroxide solution and Brix was measured on a Zeiss refractometer. The oil content was determined according to the procedure outlined in the U. S. Standards for Grades of Frozen Concentrate for Lemonade (6).

The juice from the additional 20 pounds of fruit harvested October 20 was used in a second experiment in which various amounts of oil of lemon USP manufactured by the California Fruit Growers Exchange, Products Department, Ontario, California,b/ was added to the juice before it was made into concentrate for lemonade. A 3000 ml. portion of burr reamed juice without natural Meyer oil, and 3000 ml of juice from the screw press extractor containing .16 percent natural Meyer oil, were divided into 1000 ml. samples; and .05, .10, and .15 per cent by volume oil of lemon added to the burr reamed juice, and .01, .03, and .05 percent by volume was added to the screw pressed

Table 1.

The yield, acid, Brix, and oil content of fresh Meyer lemon juice

Date harvested and method of juice extraction	Fresh Juice			
	Yield (%)	Acid (%)	Brix (°)	Oil (%)
August 19				
Burr reamed	46	4.75	7.4	.0
Hand squeezed	38	4.85	7.2	.042
Screw pressed	—	—	—	—
September 21				
Burr reamed	58	4.75	7.4	.0
Hand squeezed	52	5.10	7.4	.038
Screw pressed	50	4.52	7.2	.210
October 20				
Burr reamed	60	4.75	7.4	.0
Hand squeezed	54	4.90	7.2	.026
Screw pressed	53	4.50	7.2	.160
November 18				
Burr reamed	61	4.51	7.4	.0
Hand squeezed	54	5.00	7.2	.014
Screw pressed	55	4.56	7.4	.158

(a) One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

juice. These percentages of added oil were used because a preliminary taste test showed that .02 percent oil of lemon added to burr reamed juice and made into a concentrate, was not sufficient to add the desired additional flavor to the reconstituted lemonade. The addition of .20 percent oil of lemon to the burr reamed juice and made into a concentrate, was calculated to be slightly more than the .02 ml. per 100 ml. recoverable oil in Grade "A" lemonade defined in the United States Standards for Grades of Concentrate for Lemonade (6). Therefore, .05, .10 and .15 percent were used in the burr reamed juice. The .16 percent oil in the screw pressed juice, after being made into a concentrate and reconstituted, would contain the maximum amount of recoverable oil to meet the requirements of a Grade "A" concentrate, therefore, the amounts of .01, .03, and .05 percent added oil were arbitrarily decided upon to enhance flavor and at the same time maintain the total oil content in the reconstituted lemonade close to a Grade "A" product.

Sugar was added to all samples of juice, those with oil added and those without oil added, to produce a 45° Brix concentrate for lemonade. In preparing the concentrate for lemonade throughout the season, it was found more advantageous to keep the Brix constant and adjust the Brix to acid ratio when the concentrate was reconstituted for flavor evaluation, rather than try to prepare a concentrate of known Brix to acid ratio for each harvest. Samples were dispensed into 6 oz. plain tin cans, sealed, frozen, and stored in still air at 0° F. (17.8° C.).

All experimental lots of frozen concentrate for lemonade were opened for evaluation after they had been stored from 13 to 16 months. To reconstitute the samples for evaluation of the lemonade quality, water was added until the acidity of the lemonade was .69 percent. The amount of water added was approximately 4.5 volumes for each volume of concentrate. When necessary the Brix of the lemonade was adjusted by adding small amounts of sugar so each sample had a 16.:1 Brix to acid ratio.

The procedure for flavor evaluation of the reconstituted lemonade without oil of lemon added was conducted as follows: Each of 8 judges was presented a reference sample of lemonade prepared from a commercial brand of concentrate to familiar-

Plan To Attend The Florida Citrus Exposition February 15-22

ize himself with the flavor. Then each judge was presented 4 samples of lemonade made from the burr reamed juice from lots harvested on August 19, September 21, October 20, and November 18, and one sample of the commercial brand, and asked to evaluate each as excellent, good, fair, or poor. The samples were re-arranged and judged a second time. Lemonades made from the hand squeezed juice and that made from the screw pressed juice were evaluated in like manner.

Table 2.

Flavor rating of lemonade prepared from Meyer lemon concentrate for lemonade without added USP oil of lemon

Date Harvested	Method of Juice Extraction: Burr reamed	Hand squeezed	Screw Pressed
August 19	1.6*	2.4	—
September 21	1.8	2.4	2.3
October 20	1.8	2.6	2.3
November 18	1.6	2.3	1.7
Least significant difference between dates harvested			
.01 level	1.2	1.2	.7
.05 level	.8	.8	.4
Least significant difference between methods of juice extraction			
.01 level	.7		
.05 level	.3		

*The numbers represent numerical opinions of the judges. The word description of each number in the scale is: Excellent 4, Good 3, Fair 2, Poor 1.

The following day and again the third day additional samples of lemonade were prepared and presented to the judges for evaluation. At all times a reference sample of the same commercial brand of lemonade was available to the judges for comparison.

The same 8 judges were then given one control sample without oil added, and three samples of lemonade made from burr reamed juice with .05, .10, and .15 percent oil of lemon added, and asked to evaluate each as excellent, good, fair, or poor. Lemonade prepared from the screw pressed juice with .01, .03, and .05 percent oil of lemon added, was judged in a like manner. The samples were re-arranged and judged a second time. All samples were freshly prepared each day and judged on three consecutive days.

Results and Discussion

The percentage yield of fresh Meyer lemon juice increased from the August 19th harvest to the November 18th harvest for each of the three methods of extraction. The largest percentage increase occurred between the first and second harvest. Fruit harvested August 19 was very firm, green in color, and the juice sacs were tough. The yield of the screw pressed juice cannot be compared with the other two methods of extraction because the samples were too small to completely recover from the screw type extractor (Table 1).

The acid and Brix of the fresh juice did not change appreciably from month to month during the 4 months testing period (Table 1). However, juice extracted by hand squeezing was higher in acid each time during the 4 months than either burr reamed juice or screw pressed juice.

The oil content of the hand squeezed and screw pressed juice decreased rather uniformly from the August 19 harvest to the November 18 harvest. As the fruit matured the skin became thin and leathery and the inside of the fruit became soft. The burr reamed juice did not contain sufficient amounts of natural oil to be measured by the procedure used.

The date the fruit was harvested, i.e. August 19, September 21, October 20, or November 18, had little effect on the flavor rating of lemonade prepared from concentrate for lemonade made without added oil of lemon (Table 2). Lemonade prepared from burr reamed juice without natural oil and without oil of lemon added, developed an aroma and flavor associated with that of "musty hay" and was considered by all judges to have the poorest quality. The hand squeezed juice with a natural oil content of .014 to .042 percent, made as good a lemonade as the screw pressed juice with an oil content of .158 to .210 percent. However, lemonade prepared from the latter juice was considered too oily to the taste.

The addition of .15 percent by volume of oil of lemon to burr reamed Meyer lemon juice without natural oil (Table 3), resulted in a lemonade which was as acceptable as lemonade prepared from the commercial brand of concentrate for lemonade used as the reference sample in this experiment. The lemonade with .15 percent oil added was given a flavor rating of 3.9 out of a possible 4, while commercial lemonade received a rating of 3.8. An analysis of variance failed to show there was a significant difference between the two samples (Table 3). Smaller amounts of oil of lemon added to burr reamed juice resulted in a lemonade which was bland. The three samples of lemonade made from screw pressed juice with .16 percent natural oil, and .01, .03, and .05 percent commercial lemon oil added, had a pronounced oily taste (Table 3).

Summary and Conclusions

The dates of harvest, August 19, September 21, October 20, and No-

Table 3.

Flavor rating of lemonade prepared from Meyer lemon concentrate for lemonade containing added USP oil of lemon

Sample	Meyer lemon oil content in juice %	USP oil of lemon added to juice %	Total oil content in juice %	Flavor* rating
Control	.00	.00	.00	1.8
Burr reamed	.00	.05	.05	2.5
Burr reamed	.00	.10	.10	3.1
Burr reamed	.00	.15	.15	3.9
Commercial lemonade	—	—	—	3.8
Least significant difference				
.01 level				.3
.05 level				.2
Control	.00	.00	.00	1.7
Screw pressed	.16	.01	.17	2.5
Screw pressed	.16	.03	.19	2.4
Screw pressed	.16	.05	.21	2.3
Commercial lemonade	—	—	—	3.9
Least significant difference				
.01 level				.7
.05 level				.5

* See Table 2

vember 18, had little effect on the acid or Brix of the fresh juice, nor did the date the fruit was harvested have any significant influence on the flavor of concentrates for lemonade, prepared from this juice. However, lemonade prepared from the concentrate for lemonade made from hand squeezed juice or screw pressed juice was preferred to lemonade prepared from the reamed juice.

When a concentrate for lemonade was prepared from Meyer lemon juice without oil of lemon added, the flavor of the lemonade as determined by the judges, was inferior to lemonade prepared from a commercial brand of concentrate for lemonade, regardless of the amounts of natural Meyer lemon oil which could be squeezed into the juice by the methods used in this experiment.

A very good frozen concentrate for lemonade was prepared by adding sugar and .15 percent by volume of oil of lemon to Meyer lemon juice which had been burr reamed in such a manner that a measurable amount of natural Meyer lemon oil could not be detected in the juice.

Acknowledgments

The author gratefully acknowledges the cooperation of Dr. E. O. Olson, Plant Pathologist, Crops Research Division, ARS, U. S. Dept. of Agric., and Rio Farms, Inc. for supplying the lemons necessary for the investigation.

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a/ One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

b/ The mention of trade products or companies does not imply that they are endorsed or recommended by the U. S. Department of Agriculture over similar products or companies not mentioned.

POLK COUNTY SENIOR WINS BORDEN AWARD FOR EXCELLENT WORK

James A. Thornhill, Winter Haven, a student in dairy husbandry at the University of Florida College of Agriculture, has been awarded the Borden Company scholarship as the outstanding senior agriculture student.

The award, which is worth $300, was presented by R. L. Shortlidge of the Borden Southern Company, Jacksonville, in a special ceremony in the Dairy Science Building on the university campus. In addition to the money, the student receives a certificate and his name is placed on a bronze plaque in the Dairy Science Building. Thornhill's will be the 13th name on the plaque.

To receive the award a student must have the highest grade point average in his class in all work taken prior to the beginning of his senior year, and he must have taken at least two dairy courses.

Better Methods of Preserving Quality of Fruits And Vegetables

. . . By . . .

W. T. PENTZER, CHIEF,
BIOLOGICAL SCIENCE BRANCH,
MARKETING RESEARCH DIVISION,
AGRI. MARKETING SERVICE,
USDA, WASHINGTON, D. C.

AT MEETING FLORIDA STATE HORTICULTURAL SOCIETY

Introduction

I would like to discuss this morning some of the things that have been done to preserve the quality of fresh fruits and vegetables as they move from farm to consumer. We shall be talking about an important segment of the food industry, with annual retail sales of 7 billion dollars. Each of us consumed about 337 pounds of fresh fruits and vegetables in 1956 and 207 pounds of processed fruits and vegetables. Together they made up almost 1/3 of the total food consumed. The production for the fresh market amounted to 60 billion pounds in 1956 (farm weight). The amount of fresh produce marketed each year continue to rise as population increases and we need to increase production about 930,000,000 pounds each year just to keep up with population.1/

We are talking about an industry that offers to the consumer the greatest variety of good quality, well packaged fruits and vegetables that the world has ever known. Last Saturday I visited a neighborhood supermarket in the Washington, D. C., area on a shopping expedition with my wife and I lingered long enough in the produce department to count 41 different kinds of fruits and vegetables, not considering different varieties. There were Northwestern Delicious apples, Florida grapefruit, Long Island, New York, cauliflower, California grapes and lettuce, and other produce from many different States. I have learned that it is not unusual to find 70 different fresh fruits and vegetables in a modern market and during the year the total number reaches more than 100. If only the main varieties are counted, the number goes to 205. 1/

We are enjoying not only variety, but out of season delicacies thanks to increased production in southern areas, increased imports and improved storage and distribution techniques. Sweet corn is an example. In 1945, there was no green corn on the New York market from December through March. Ten years later, in 1955, there was corn for sale in every month of the year. Florida production was responsible for this. The season is also extended for strawberries, cantaloups, honeydew melons, grapes, cucumbers, eggplants, grapefruit, mushrooms and some varieties of apples.

Notable Achievements

What are some of the advances that have made wide distribution of high quality fresh fruits and vegetables possible? I would have to list first and foremost, a good transportation system with refrigerator cars, icing facilities, and fast-moving trucks and trailers. Precooling, packaging, storage, refrigeration at the retail store and supplemental treatments for the control of decay all have played their part in developing the fruit and vegetable business. Let us have a quick look at what is going on in these fields that is important to the subject of our discussion, better methods of quality preservation.

Refrigerated Transport

The first refrigerator cars were built in 1857 but it was not until after 1872 that railroads began to make well insulated cars and the forerunner of our present fleet of refrigerator cars was started. Today the railroads own about 97,000 refrigerator cars of the general service type. Approximately 70 percent of them are equipped with fans. I believe the installation of fans was the most important improvement in refrigerator cars since insulation, ice-bunkers and floor racks were adopted as standard construction.

The fans are driven from the car wheels, either by direct drive or by a generator which furnishes electricity for fan operation. They circulate 3000 to 5000 cfm of air from the ice-bunkers at each end of the car towards the center of the load. Fans speed up removal of field heat and make the refrigerator car an efficient pre-cooler when motors are attached. Fan cars have done much to help the produce industry to deliver a quality product, for they are insurance against high temperatures in the top layers of the load in summer months, and too cold temperatures in the bottom layers in winter months.

Some experimental work is going on to perfect a thermostatically controlled fan system, so that refrigeration would be supplied from the ice-bunkers only when called for, rather than continuously. This would be of most value to commodities requiring moderate temperatures such as tomatoes, which should not be cooled lower than 55° to 60° because of danger of chilling injury. Some attention is also being given to continuous fan operation from storage batteries.

Mechanically refrigerated railroad cars are not available for fresh fruit shipments except in limited amount. There are now in service about 2000 cars of this type, constructed for the transport of frozen foods. Additional cars will be built this year, some of which are intended for fresh fruits and vegetables. It

1/ Seelig, R. . Fresh facts about the fresh fruit and vegetable industry. June 1957 — United Fresh Fruit and Vegetable Association, Washington, D. C.

is too soon to predict their value in quality preservation of fresh fruits and vegetables.

Table I

Commodity	Reps to Injury Commodity	Reps to kill organism		Reps to delay action
Strawberries	300,000	Botrytis cin.	200,000	200,000
		Rhizopus	500,000	200,000
Lemons	200,000 to 300,000	A. citri	500,000	300,000
		P. digitatum	1,000,000	100,000 to 200,000
		P. italicum	150,000	125,000
Navel oranges	200,000 to 300,000	A. citri	500,000	300,000
		P. digitatum	1,000,000	100,000 to 200,000
		P. italicum	150,000	125,000
Walnuts	50,000	—	—	—
Pecans	50,000	—	—	—
Apples	300,000	P. expansum	500,000	500,000
Onions	200,000 to 400,000	Botrytis allii	500,000 to 1,000,000	150,000 to 200,000
		R. Nigricans	500,000	200,000 to 250,000
Peaches	400,000	M. fructicola	300,000	150,000 to 200,000
Tomatoes	500,000	A. tehius	500,000	300,000
Grapes	500,000	Botrytis cin.	200,000	200,000

Thermostat control of temperature offers possibilities for certain commodities that require moderate temperatures. If the cars can hold uniform temperatures of 31° to 32° without danger of freezing or drying out the commodity, they will help to deliver many of our perishables in better condition. Trucks and trailers are moving about 60 percent of the fresh fruit and vegetable crops, according to some estimates.

The biggest contribution highway transport has made to the quality of fruits and vegetables is the shortening of delivery time and the flexibility of the service from packing house to receiver. Refrigeration capacity is usually limited, requiring precooling if warm loads are to be transported any great distance. Just how many refrigerated trucks are on the road is difficult to determine.

In 1953, there were an estimated 195,000 but most of these were in city delivery service and were refrigerated by cold plates and dry ice. There were 48,124 mechanically refrigerated trucks and trailers and over 12,000 ice refrigerated vehicles.

Precooling

The removal of field heat quickly from fruits and vegetables has been an important development insofar as quality retention is concerned. Putting ice in the package of lettuce or broccoli is a quick, simple method of field heat removal. Air-cooled precooling plants are common in California and the Pacific Northwest. Car precooling using ice in the bunkers of refrigerated cars or with mobile mechanically-refrigerated units is a common practice. Vacuum cooling is the most recent development, starting about 1948 with lettuce in California. The Western lettuce industry was founded on refrigeration by package ice and top icing in transit. It has changed to dry-pack in cartons and no top ice. Shipment is in fan-cars, with ice in the bunkers.

Here we have an improved method worth noting because of several things it accomplished. Vacuum cooling extracts heat quickly from a packed carton of lettuce. This permitted the dry-pack lettuce industry to expand its markets beyond the Pacific Coast, for lettuce cooled to 36°-38° after packing by vacuum cooling, could be transported long distances in fan cars without the need of top ice. We should make it plain here that the value of package ice in the old type pack was to precool the lettuce, to get out the field heat quickly. It usually accomplished this in 6 or 8 hours. As

much can be done in ½ hour by vacuum cooling.

Did this change in the refrigeration and packaging of lettuce result in better quality? The answer is yes, if everything was done right. Some of the specific advantages were:

(1) Avoidance of mechanical damage to the lettuce from ice in the package.

(2) No water-soaking of the heads from package ice and top ice and subsequent shortening of market life.

(3) A package easier to handle and better suited to retail store display.

(4) Less handling of the lettuce because of field packing, less mechanical damage.

We have mentioned vacuum cooling as one of the advances in the refrigeration of lettuce. You may ask, does it offer the same promise for other fruits and vegetables? The answer is probably no. There is nothing mysterious about the process, it is simply a means of removing heat by evaporating some of the water the commodity has in it. About 1000 B.T.U. are removed for each pound of water evaporated. Evaporation must be done at a lowered pressure to obtain a refrigeration effect and to reach 32° F. almost a complete vacuum, equivalent to 29.74 inches of mercury, must be used. To cool 100 pounds of lettuce 30° F. about 3 pounds of water must be evaporated, and the produce would suffer a 3 percent weight loss. The actual figures are not far from these.

Vacuum cooling will not work on fruits and vegetables that do not lose water easily. This puts oranges, potatoes, apples, and similar fruits and vegetables out of practical consideration and leaves us mostly the leafy vegetables or small fruits to experiment with. You are no doubt aware that sweet corn, celery, broccoli, several other vegetables, salad mixes and strawberries have been vacuum cooled on a commercial scale. But lettuce is still the big item.

Hydrocooling must be mentioned in the discussion of precooling. It is not a new process and was first used commercially for Florida celery. The idea spread to California, and an ice-refrigerated cooler was developed by the Union Ice Company and was later made by Food Machinery. Its first application was in shipping asparagus and it is still used on this commodity, giving a fresher, more attractive product than could be obtained by air precooling. Hydrocooling spread to celery, sweet corn and other vegetables in a small way. It was used as a means of cooling peaches experimentally in Michigan and became widely used in South Carolina and several other peach districts. Hydrocooling is a quick way to remove heat, accomplishing as much in 10 to 15 minutes as can be done in 8 or 10 hours car precooling with air. It enables peaches to be shipped that are picked at a riper stage of maturity and this permits the marketing of high quality fruit.

Refrigerated Display Cases

Much has been said about the chain of refrigeration from field to housewife that is used to protect the quality of perishables. The chain usually broke when the produce reached the market. Great care was given to precooling and refrigeration in transit, and just when the produce needed refrigeration the most, at the end of its long journey, it received none at all. Perishables can be seen standing in the sun on summer days in almost any wholesale and retail market. Things are improving, however.

Some retail stores get these fruits and vegetables daily or frequently during the week from a central warehouse. The produce moves directly from the refrigerator car or truck to refrigerated rooms in the warehouse. The room where orders are assembled may be air-conditioned so that it never gets really hot. The retail store is air-conditioned and has refrigerated display cases. In one modern supermarket I visited recently I found 250 feet of refrigerated cases for fresh fruits and vegetables.

A survey of 13,400 independent grocery stores in 1954 showed that 83 percent had refrigerated cases for produce, that the amount averaged 20 feet per store and had increased about 13 lineal feet during the year. 2/ The greater use of refrigeration in retail stores and wholesale channels is one of the most important advances in quality protection of perishables of the last 10 years.

Protective Packaging

A revolution has come about in the field of packaging. How much of the change has resulted in better quality? We can name a few instances where packaging has helped. Consumer-size packages of good visibility have helped to prevent damage to produce by customers in retail stores. Plastic films retard moisture loss and keep produce fresher than non-packaged produce. This has been especially important for leafy vegetables but it has helped citrus and other fruits. Polethylene film box liners, used for some varieties of apples like Golden Delicious, that wilt badly in storage has largely eliminated this difficulty.

Packaging in polyethylene films to create an artifical atmosphere has had some success with pears and sweet cherries in the Pacific Northwest. For this use the film is sealed and a few small perforations are made in it to allow a build up of safe concentrations of carbon

dioxide and lowering of oxygen by fruit respiration. Under these conditions, the fruit respires more slowly and retains its quality longer in storage. One to 2 months has been added to the storage life of pears by this method and 2 to 3 days to the market life of cherries.

The tolerance of various fruits and vegetables to CO_2 and low O_2 differs and they can be damaged if safe limits are exceeded. Application of this type of controlled storage tc citrus and subtropical fruits has not been successful as yet.

Controlled Atmosphere Storage

Certainly, controlled atmosphere storage for apples of the McIntosh variety must be acknowledged as a better method of preserving quality than ordinary cold storage. Here we have an apple not tolerant of 32° for long storage because of brown core and at 36° to 40°, where this functional disease does not develop, it ripened too fast. If CO_2 was built up to 5% and oxygen reduced to 3% from the normal 20% in air, McIntosh apples could be held until spring at 36° to 38°.

There is now controlled atmosphere storage capacity of about a million bushels in the Northeastern States There is research going on to see if it would keep Northwestern Delicious apples in better condition until summer and certainly, the method offers promise for pears. Its application to citrus fruits appears to be doubtful.

Chemicial Treatments

There is no need here to enumerate all of the chemicals that have been tried as supplements or aids to refrigeration. Some, like borax and hypochlorite, have long been in use for citrus fruits. Sodium orthophenyl-phenate (Dowicide A) must be given attention as a fungicide growing in use for citrus fruits in California. It is widely used for apples and pears in the Pacific Northwest. It shows some promise for control of peach rots and a tolerance of 20 p.p.m. has been established for this application. The Dowicide A-hexamine treatment for citrus fruits was worked out in Florida and you do not need to be told about it.

Ammonia is getting a good trial in California as a mold inhibitor, using pellets to release ammonia in the package or using ammonia in fumigation chambers. There are still difficulties of release to be overcome.

Diphenyl-treated containers, pads, liners or wraps have been used for citrus fruits, and a tolerance of 110 parts per million has been established by the Food and Drug Administration. It must be considered a valuable adjunct to refrigeration for spoilage of citrus fruits.

Antibiotics

Insofar as I know, we have no antibiotics that can be used on fruits and vegetables. Streptomycin sulfate has been helpful in protecting spinach and leafy vegetables from bacterial soft rot, but its use is not permitted by the Food and Drug Administration. We have all heard of the use of chlorotetracycline (aureoemycin) and oxytetracycline (terramycin) for lengthening the shelf life of poultry. These antibiotics are permitted because they are heat labile and no one is expected to eat chicken without cooking it.

Irradiation

Much has been said about irradiation of foods. This is a subject in itself. Our particular interest is its possible application to fresh fruits and vegetables. Working with funds supplied by the Army Quartermaster and using the gamma ray source at Argonne near Chicago, we have determined the approximate minimum dosage it takes to injure the fruit or vegetable and what it takes to kill fruit rot organisms and to delay infection.

Most fruits, including lemons and

oranges, were injured by 200,000 to 300,000 rep. A "rep" is a measure of radiation dosage. Walnuts and pecans were injured by only 50,000 rep. Peaches withstood 400,000 rep, and grapes and tomatoes 500,000 rep. Most of the common fruit rot organisms such as Rhizopus, Alternaria, Botrytis, Penicillium digitatum and P. expansum required 500,000 rep to get complete kill.

This rules out gamma irradiation as a sterilizing media, for the produce would not withstand enough exposure for a complete kill of surface microorganisms. We must look to less than sterilizing dosages—dosages that would delay infection and give us longer market life if we used it in combination with refrigeration.

There is promise with peaches, tomatoes, grapes and strawberries. Citrus fruit do not look too promising, but more work needs to be done. Alternaria citri required 300,000 rep for delayed action, but lemons were injured by 200,000 to 300,000 and oranges (navel) by the same dosages. P. digitatum and P. italicum required 100,000 to 200,000 rep to delay infection. When radiation facilities large enough to treat commercial containers become available, the practical value of irradiation can be determined.

Unsolved Problems

We have a lot of problems yet to be solved and one of the most baffling is the cause of chilling of tropical and subtropical fruits. Pitting, breakdown and off-flavor in grapefruit precludes long storage at 32° to extend the marketing season into July, August and September. At higher storage temperatures of 55° to 60°, where chilling does not take place, Florida grapefruit develop too much decay. The whole question of chilling injury needs investigation, for it is a problem with many of our common fruits and vegetables such as melons, spinach, cucumbers, tomatoes, peppers, oranges, lemons, grapefruit, limes, oranges, avocados and others.

We are not getting high quality sweet corn to the consumer from Florida. Some of the faults are poor hydrocooling and lack of refrigeration after it reaches the market.

The problem of decay in citrus fruits from Florida is serious in some crops and at certain times of the year. Tangerines and Temple oranges are particularly susceptible, but the more resistant oranges and grapefruit also sometimes go down with decay after they reach the market. To protect against loss to his customers, one of my friends in the gift package business uses the Dowicide-hexamine treatment, precooling, and refrigerated transport for his shipments of Temple oranges and grapefruit out of Florida and has had no claims for refunds because of decay on deliveries that he makes to various parts of the country.

Poor quality tomatoes are the source of consumer complaint. I am inclined to believe that poor ripening and handling practices on the market are the chief reasons, but maturity and handling at the packing house and in transit cannot be ignored as possible sources of trouble.

These examples, and we could give more, will indicate there is still work to be done in education and research if we are to improve the marketing of fresh fruits and vegetables.

Summary

The fresh fruit and vegetable industry to reach its present size has had to overcome difficulties imposed by distance to markets, and the perishable nature of the commodities to be shipped. Advancements in refrigerated transport, precooling, the use of refrigeration at the retail store and wholesale market, the development of improved packaging, and storage and the use of treatments to aid in the control of spoilage organisms have all played important roles in developing the wide distribution of perishables we enjoy today.

FIRST ENTRY!

Kay MacLean, 19-year-old Tampa blonde, has become the first entry in the 1958 Florida Citrus Queen contest to be held at Winter Haven, Feb. 17-19, as a feature of the Florida Citrus Exposition. Kay, a voice major at Florida State University in Tallahassee, is sponsored by the Haines City Citrus Growers Association. She will sing in the talent segment of the beauty contest, ranked third in importance and value in the country.

GUMMOSIS SOMETIMES PLAGUES CITRUS TREES

Gummosis often plagues dooryard citrus trees, says Citriculturist Fred P. Lawrence, with the Florida Agricultural Extension Service.

The symptom is gum oozing out of tree limbs. The cause is an out-of-balance of nature. It could be the result of rootrot; mushroom rootrot, incompatibility of rootstock, chemical injuries or excessive fertilization.

If the lesions are not caused by disease and do not become infected with secondary organisms, they should heal over. To prevent the chance of infection, clean the gummed area with a wire brush, then paint it with a good tree paint.

CITRUS INSECT CONTROL FOR JANUARY, 1958

(Continued from Page 5)

gallons of spray is currently recommended although as little as ½ pound per 100 gallons will give amazingly good control.

Tedion is believed compatible with all of the spray materials commonly used on citrus.

Tedion is very slow to bring mites under control, usually a week or more being required, but control is exceptionally long. In fact, under most conditions, growers can expect better control of purple mite and Texas citrus mite for longer intervals with this material than with any other available miticide. Tedion has been effective during the warm spring months as well as in the winter. Tedion is of no value against rust mite and must be supplemented with sulfur or zineb wherever rust mite is a problem.

Trithion is a formulation of 0,0 Diethyl S-p-chlorophenylthiomethyl phospherodithioate and is available as a 25 percent wettable powder as well as a liquid formulation called Flowable Trithion. The latter contains 4 pounds of the active ingredient per gallon. Trithion is recommended in good coverage sprays at dosages of ½ pint of the Flowable Trithion or 1 pound of the wettable powder per 100 gallons against both purple mite and Texas citrus mite only on trees without fruit.

Trithion is believed to be a reasonably safe material, but it is an organic phosphate. All handling precautions that may appear on the manufacturers label should be strictly observed.

Trithion gives a fast kill of purple and Texas citrus mites, and is about as effective against rust mite as wettable sulfur, but not as effective as zineb. Although Trithion appears to be fairly effective during warm weather, it is not as effective during warm weather as Tedion.

Six-spotted Mite Control: Six-spotted mite often appear in small numbers during January. Usually they first appear on rough lemon sprouts, although they may also be found around colonies of purple scale, especially on grapefruit trees. Dormant applications of any of the miticides used for purple mite control as well as 2 gallons of lime-sulfur per 100 gallons of spray will help to prevent the spring build-up of six-spotted mite. The lower surface of leaves must be covered with the spray for maximum control because

this mite prefers the underside of the foliage.

Scab Control: Wherever scab is a problem on Temples, tangeloes and grapefruit, an application of copper should be made before the appearance of new growth. New growth may occur at any time. Neutral copper compounds should be used at the rate of 3/4 pound of actual copper per 100 gallons. If scab is a severe problem,, however, the dosage should be doubled. Do not use copper compounds with lime-sulfur.

Details of spray schedules and the various materials used will be found in the "Better Fruit Program" and this should be consulted to determine which materials may or may not be combined. For further information, consult the Citrus Experiment Station at Lake Alfred or Fort Pierce.

Zineb For Control of The Citrus Rust Mite — Some Timely Questions and Answers...

(Continued from Page 7)

sprayed trees as on sulfur-sprayed trees. Texas citrus mites are often more numerous where zineb has been used than where sulfur has been applied because sulfur reduces their numbers while zineb does not. Zineb has no appreciable effect on Texas citrus mites.

11. Q. When zineb is used in June or July, what purple mite control program should follow?

A. Purple mites should be controlled during the fall and winter whether zineb or sulfur is used during June or July. Zineb does not control purple mites or Texas citrus mites. Groves should be sprayed for purple mite control in the fall and winter before more than 20% of the leaves are infested.

12. Q. Can citrus fruit russet after the use of zineb?

A. Yes, if rust mites are allowed to become too numerous they will russet fruit at any time.

13. Q. Are brushing-type zineb sprays effective against rust mites?

A. No. Brushing-type sulfur sprays are usually effective against rust mites because sulfur has some fumigating action. Thorough coverage is necessary for good rust mite control with zineb because zineb has no fumigating action and rust mites do not move around enough to contact zineb residues.

14. Q. I don't plan a thorough application of zineb. Would it be better to use 1 pound instead of 1/2 pound of zineb per 100 gallons?

A. No. Sulfur is recommended in preference to zineb where thorough coverage cannot be obtained. An increase in the dosage of zineb will not make up for poor coverage.

15. Q. Can zineb be used as a dust?

A. Zineb dusts are commercially available, but have not been tested on citrus.

16. Q. If fruit is going to a processing plant, will it pay to use zineb to control rust mites on foliage?

A. Statistics to answer this question are not available, but it is believed that the superiority of zineb over sulfur makes the use of 1/2 pound of zineb per 100 gallons economical even on canning plant fruit.

17. Q. Should sulfur be left out of the spray program altogether? Why not?

A. No. There is no information to definitely support the negative point of view, but it is believed that sulfur should not be completely removed from the spray program because sulfur may be more important in the control of flat mites and broad mites than has been realized in the past. Another reason is that sulfur reduces Texas citrus mites and zineb does not. It is recommended that sulfur be used in the fall and winter and/or post-bloom sprays and zineb in the post-bloom and/or summer sprays.

18. Q. Is there any advantage to using wettable sulfur with zineb?

A. Wettable sulfur and zineb combinations have not been tested. It seems, however, that there would be little advantage to such mixtures.

19. Q. What is the best way to mix zineb and oil emulsion?

A. Zineb should be completely mixed with clear water before adding the oil.

20. Q. Since zineb is sold in 3 pound bags, can I use 3 instead of 2-1/2 pounds of zineb per 500 gallon tank?

A. Yes, no difference in rust mite control can be detected between 2-1/2 and 3 pounds of zineb per 500 gallon tank. Thorough coverage is necessary with either amount.

21. Q. Is it advisable to use a wetting agent in the zineb sprays?

A. No. Zineb has been carefully compared with zineb plus wetting agents for rust mite control and no difference has been detected.

22. Q. What is the effect of rain on zineb as compared to sulfur?

A. Zineb is far more effective than sulfur against rust mite during rainy weather. In one case, rust mite control was superior with zineb even though heavy rain occurred before the zineb spray had dried while sulfur had been on the trees for 24 hours.

23. Q. Is there any difference in effectiveness between different brands of zineb?

A. No difference has been observed between the three brands used in tests.

24. Q. How fast do zineb residues break down?

A. Zineb residues on citrus foliage are quite persistent. Dr. J. J. McBride, Assistant Chemist at the Citrus Experiment Station, has found that where zineb was used alone, one-half of the zineb residue was gone after 9 days; where zineb was used with parathion, 1/2 of the zineb was gone after 13 days; and where zineb was used with oil emulsion, 1/2 of the zineb had disappeared by 21 days.

25. Q. Will nabam control rust mites?

A. Nabam alone is not as good as sulfur for rust mite control and may cause a burn. One quart of nabam with 1/2 pound of zinc sulfate is better than wettable sulfur, but not as good as zineb.

26. Q. Can zineb be used instead of copper in January and February to control scab and melanose?

A. No. Zineb is much less effective than copper for the control of both scab and melanose.

27. Q. Can zinc nutritionals be reduced where zineb is used?

A. No. Dr. Ivan Stewart, Associate Biochemist, and Dr. C. D. Leonard, Associate Horticulturist at the Citrus Experiment Station, have found no measurable uptake of zinc in either old or new leaves from zineb sprays and point out that, at a dosage of 1 pound of zineb per 100 gallons, zineb supplies only 1/7 as much zinc as a standard nutritional spray. No reduction in nutritional sprays should be attempted because of the use of zineb, especially on zinc-deficient trees.

28. Q. What effect does zineb have on greasy spot?

A. Zineb controls greasy spot, but is less effective than copper compounds.

29. Q. Does zineb affect fruit maturity?

A. Research by Dr. E. J. Desyck, Associate Horticulturist at the Citrus Experiment Station, has shown that zineb has no effect on either maturity or internal quality of either grapefruit or oranges.

30. Q. Does zineb harm beneficial insects and fungi? Snails?

A. Zineb has been used in snail groves with no noticeable effect on the snails. Although some work is being done on the effect of zineb on certain beneficial insects and fungi, no information is yet available.

31. Q. Does zineb cause a rash to workers and what can be done about it?

A. Many grove workers have experienced skin rashes after handling zineb. Persons handling zineb should avoid contact with the material through use of clean protective clothing. Susceptible individuals should be kept away from zineb and those who have acquired skin rashes should see a physician.

32. Q. Has zineb caused any injury to foliage or fruit?

A. No injury to citrus foliage or fruit has been observed.

33. Q. Has zineb had any effect on the amount of fruit drop?

A. None has been demonstrated so far.

34. Q. How does zineb compare in cost with wettable sulfur?

A. Prices vary somewhat. At present, 1/2 pound of zineb costs about $.38 while 10 pounds of wettable sulfur costs about $.31. Growers should keep in mind the fact that relative costs of materials do not take into consideration other factors such as length of control. A thorough post-bloom or summer application of zineb will outlast sulfur.

Improvement of the grounds of the Flat Creek Community Church is a project of the home demonstration club in that community. Mrs. Marjorie B. Gregory, Gadsden County home demonstration agent, says this is the third such project in the county this year.

Some Future Problems And Future Possibilities In Florida Agriculture

As They Relate To The Facilities And Staff Of The Florida Agricultural Experiment Stations

J. R. BECKBENBACH, DIRECTOR
UNIVERSITY OF FLORIDA
AGRICULTURAL EXPERIMENT
STATIONS
AT MEETING FLORIDA STATE
HORTICULTURAL SOCIETY

(Concluded From Last Issue)

Stations Farm 10,000 Acres

The Florida Stations own and farm something over 10,000 acres of land. Without a doubt, we carry the most diversified farming operation on this land of any public or private operator in the state. Perhaps you would be interested in knowing that we sell produce and livestock through regular markets. We average out a gross income of around $35.00 per acre overall, which doesn't sound too bad, on the face of it. I'm going to resist the temptation of giving you a NET income figure. This would be a very bright red indeed if we had to exist on these sales, alone. Only by the grace of our appropriations can we erase the red ink.

On these lands we work about a thousand people, in about $1,500,000 worth of buildings, not counting those used jointly by the College of Agriculture. We operate in 24 different locations, scattered from extreme West Florida, above Pensacola, to Homestead. We operate 120 trucks, and 86 tractors, not including some 24 garden tractors. We have about 3,000 head of beef cattle, over 500 head of swine, about 70 sheep, some cow ponies, a few goats, and some thousands of chickens. I can't give you a count of our citrus or avocado trees, but perhaps you get the picture of the diversity of our program.

In this connection, I might add that it is a very rare day indeed that someone, in some places of Florida's agriculture, doesn't run into a problem that needs to be called to our attention. A fair number filter through to me; some come direct to me. I keep a philosopher's counsel constantly on my desk for the rougher moments. This pholosopher is Leroy Paige, better known in some circles as "Satchel." His soothing words go as follows, in case you have forgotten:

1. "Avoid fried meats which angry up your blood."
2. "If your stomach disputes you, lie down and pacify it with cool thoughts."

(That's hard to follow, but one of these day's I'll try to slip a requisition for a couch through the Business Manager.)

3. "Keep the juices flowing by jangling around gently as you move."
4. "Go very light on the vices, such as carrying on in society. The social ramble ain't restful."
5. "Avoid running at all times."
6. "Don't look back. Something might be gaining on you."

Laboratory Equipment

Finally, in our many laboratories we have some of the finest scientific equipment that is available. Of this, however, we never have enough. In this eletronic age, all such equipment has not only gone electronic, but new yearly models come out, as with automobiles. Even so, such equipment is a "must" in this day and age, and it is a bargain. With it, a chemical analysis that used to take days can be performed in minutes. Without it, we would probably have to drop about half of our program in some areas, or else double our staff. For this reason, such equipment is usually a bargain at about any price.

We are currently constructing a Cobalt-60 facility at Gainesville. The gamma rays from this cobalt isotope can do several important things. They can sterilize meat, vegetables of fruits, and increase the shelf life of these products. They can increase the mutation rate of living things, so that "sports" are produced many times as fast as they would normally occur. We expect to use it in many of our breeding programs, in our food technology research, and in other research areas.

We are also currently planning a sizeable plant science research unit, which really amounts to a large piece of scientific equipment. With this facility we fully expect to be able to get answers to many complex agricultural problems that have been difficult or impossible to work on with outdoor plots and standard lab-

(Continued on Page 30)

The LYONIZER

COMPILED BY THE LYONS FERTILIZER COMPANY

Reports Of Our Field Men . . .

EAST HILLSBOROUGH AND PASCO COUNTIES
E. A. McCartney
914 River Hills Dr.
Temple Terrace, Tampa, Fla.
Phone WE 8-2852

This is a very unpleasant report about conditions in my territory. There is nothing much I can say that everyone doesn't know. This is Wednesday, December 18. The embargo went into effect yesterday. In a week or ten days we should know the extent of the freeze to citrus. Vegetables were wiped out. In checking groves we find damage seems to be light in some locations — in others it is bad.

Young trees are hurt and will be set back in their growth. Some are killed.

WEST HILLSBOROUGH AND PINELLAS COUNTIES
J. A. Hoffman, Lutz, Florida
Phone WE 9-2276

At this time, Dec. 19, we find it difficult to determine just how much damage was done to citrus by the freeze on the 12th and 13th of this month. We would like to point out that some groves show little or no sign of the freeze in the Lutz, Land O'Lakes and Palm Harbor sections while others show signs of severe cold damage to fruit and trees. Practically all early oranges, tangerines and Temples were hurt bad. Valencias don't seem to be hurt bad but only time will tell if they can outgrow the damage. At this time we feel that groves should not be cultivated. A close watch should be kept for rust mite and red spider and a miticide applied when necessary.

SOUTH HILLSBOROUGH AND MANATEE COUNTIES
Eaves Allison
P. O. Box 365, Sarasota, Fla.
Phone Fulton 8-2611

The big news at this time — Dec. 16 — is the hard freeze we have just been through and its effect on the various areas of the State.

In the Sarasota - Manatee - South Hillsborough section all winter vegetables except strawberries and celery were completely lost. Even headed cabbage was frozen in the field. Citrus shows varying degrees of defoliation from none to say 30 percent on big trees, and heavier damage on young stuff depending on locations. Damage to the fruit crop is yet undeterminable, but it is evident that we escaped with fairly light damage in this area.

The loss has been severe, just how bad will be more evident when you read this than it is now. However, everybody is digging in to prune, replant, replace and otherwise get back in shape and by spring we probably will not even know we had a freeze. There is a remarkable lack of pessimism and bemoaning over the whole area.

NORTH CENTRAL FLORIDA
V. E. Bourland
Winter Garden, Fla.
Phone 107

As you know we have had some real cold and windy weather for the last week. I think the estimators of this year's crop of fruit can reduce the present estimate materially. I have been in Florida 37 years and in that time we have had a number of freezes, but they had been low land or high land cold, this time it looks like as if it did a very good job on hitting all citrus. Up until this cold spell there hadn't been too much fruit moved, but every available person was picking fruit yesterday and today. (Written Dec.13).

It looks as though it wiped out considerable vegetable crops, also frost got much pasture grass and some ranchers are having to feed their stock.

HIGHLANDS AND POLK COUNTIES
J. K. Enzor, Jr.,
P. O. Box 1304 Winter Haven, Fla.
Phone Cypress 3-4716
R. E. Lassiter, Jr.,
1168 Lakeshore Blvd.
Lake Wales, Fla.
Phone 3-3813

The time of this writing (16th) being only four days since we experienced a severe freeze, it is still too early to determine the severity of the damage which we have received. The damage to the early and midseason oranges looks bad at this point. Where the Valencias were not too severely frozen chances are good that the fruit will recover from the damage they received.

We are recommending that growers not be in too big a hurry to do any spraying. It will be better to wait a couple of weeks after the freeze and see how we stand insect-wise.

Practically all of the growers in this area have finished their fall fertilizer application. Moisture conditions were fairly satisfactory before the cold weather. We received some rain ahead of the cold fronts as they moved in.

We would like to take this opportunity to wish everyone a HAPPY HOLIDAY SEASON!

SOUTH POLK, HIGHLANDS, HARDEE, DeSOTO AND SARASOTA COUNTIES
C. R. Wingfield
Avon Park, Fla.
Phone Glendale 2-81881

The freeze on the nights of December 12 and 13 brought back memories of the same dates of 1934 when another freeze visited the State of Florida.

I do not believe it did as much tree damage this time as was in 1934 for then there were many old trees that had to be cut to the ground. The damage this time will be to fruit and young plantings. At this writing , (18th) it is hard to estimate what loss will be incurred.

The embargo having been placed on fruit shipment and the usual holiday shut down will give time to actually see what fruit will be usable for fresh fruit shipments and canners. At present many estimates are a loss of fruit amounting to 25 to 30 percent of the overall crop. Temples and tangerines are 100 percent loss.

What should be done after a freeze of this kind is a big question. Space will not permit this answer and there are so many factors to consider, so I suggest you contact your Lyons representative and discuss this matter with him.

The loss of vegetables was heavy, with some crops left on East Coast and inland to Immokalee. I have no report from Ft. Myers area. Replanting in the warmer sections that grow winter crops are under way.

SOME FUTURE PROBLEMS AND FUTURE POSSIBILITIES IN FLORIDA'S AGRICULTUDE

(Continued from Page 27)

oratories. In effect, this will permit studies on plants, plant diseases and insects with complete climate control.

Besides making possible a dependable research program dealing with the direct effects of controlled climatic factors on crop plants and on their insect and disease organism predators, we expect to get answers on complex physiological disorders that have proven difficult to study under field conditions. Gray wall of tomatoes, bud rot of gladiolus, and the splitting of fruits are specific examples of a few of the kinds of problems that should fit into this climate-controlled facility. I believe that we have the staff to make it useful to us and to growers; I know that we have the agricultural problems.

As all of you know by this time, I have rambled quite a bit in this talk. I presume that your Executive Committee expected that, or they wouldn't have asked for a talk by one who has long since stopped being a researcher and joined the red tape divisions. Whether justified or not, I always maintain that there's a little of my life's blood in all of the research that is done in the Stations. You will notice that it has left me a rather anemic specimen.

Fresh Fruit Day At Fla. Citrus Exposition

Hundreds of men prominent in the big Florida citrus industry will meet in Winter Haven with representatives of marketing and merchandising organizations from all over the country when the Florida Citrus Exposition stages its annual "Fresh Fruit Day" on Feb. 20.

Winston Lawless, president of the industry-sponsored citrus show, said recently that Robt. K. "Bob" Cooper, general manager of the Florence Citrus Growers Association at Florence Villa would be general chairman of a committee handling details of the big feature of the day — the traditional "Fruitmen's Dinner" which will be an afternoon and evening event at the National Guard armory.

"Right now, the entire industry is concerned with the effects of the recent freeze, but in another 60 days we will be in the midst of handling a big crop of Valencia oranges and there should be plenty of interesting subjects for the special 'Fresh Fruit Day' program," Lawless said.

Florida Citrus Mutual is sponsoring the "Fresh Fruit Day" events to be held at the Florida Citrus Building's big Nora Mayo auditorium. A feature of the program will be the formal awarding of trophies and prizes in the annual fresh fruit competition.

Classified Ads

SUPERIOR CITRUS TREES available for Fall 1957 and Spring 1958 planting: Valencias, Hamlins, Pineapples, Orlandos and other varieties. Write for quotation and your FREE copy of "Care of Young Citrus Trees." WARD'S NURSERY, Box 846, Avon Park, Florida. Phone GLendale 2-7541.

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BE SURE your citrus-replant dollars are dividend-paying dollars! Treat the soil before you plant. Get your young trees off to a good, healthy start with a nematode-killing treatment of D-D soil fumigant.

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55 Marietta St., N. W., Atlanta 3, Georgia

SHELL

FLORIDA CITRUS HAD A MEAN VISITOR...

Of course, we refer to the recent cold spell, which undoubtedly did damage to crops and trees, although we believe the amount of such damage will not be nearly so bad as some have predicted.

In any event your trees will be benefitted by a close inspection as to their nutritional needs, and if they show any signs of damage the best and quickest way to bring them back to a strong, healthy condition is to provide them with ample amounts of nourishing plant food.

Such an application will not only build up strength in your trees, it will speed the growth of new foliage and add to the welfare of the crops your trees are carrying.

Now, we believe, you will find the helpful counsel of our Field Service Staff of the utmost value . . . it's yours for the asking.

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